UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
NATIONAL RISK MANAGEMENT RESEARCH LABORATORY
GROUND WATER AND ECOSYSTEMS RESTORATION DIVISION
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March 4, 2014

OFFICE OF
RESEARCH AND DEVELOPMENT

MEMORANDUM

SUBJECT: Draft Final Remedial Design and Remedial Action Work Plan for Operable Unit 2, Revised Groundwater Remedy, Site ST012, Former Williams Air Force Base, Mesa, Arizona (14-R09-002)

FROM: Eva L. Davis, Ph.D., Hydrologist
Applied Research and Technical Support Branch

TO: Carolyn D'Almeida, RPM
USEPA Region 9

I have reviewed the Draft Final Remedial Design and Remedial Action Work Plan (RAWP) for Operable Unit 2, Revised Groundwater Remedy, Site ST012, Former Williams Air Force Base, Mesa, Arizona, dated January 29, 2014. My review of the document focused on the criteria for transitioning from Steam Enhanced Extraction (SEE) to Enhanced Bioremediation (EBR) and on the monitoring to support the transition criteria. My general concerns on the transition criteria and sampling plan are stated below, followed by specific comments which provide greater detail to support my general concerns.

General Comments

1. Section 4.2.4: 'Multiple lines of evidence' are commonly used to support the decision on when to terminate thermal remediation, and commonly includes ensuring that the target temperatures are obtained throughout the treatment area, determining that the recovery rate of contaminants is diminishing to a small, relatively constant rate, and determining that groundwater concentrations verify that nonaqueous phase liquids do not remain in the treatment area. For this project, which will transition from SEE to EBR with the objective of reaching cleanup goals for benzene in 20 years, additional specific criteria may be appropriate to support this objective, such as the criteria included for dissolved benzene concentrations in the Target Treatment Zone (TTZ). In order to meet the overall objectives of the remediation, the benzene concentrations remaining in the TTZ should be the most important criteria for evaluating the progress of the SEE remediation and when to transition to EBR, as this is directly tied to the time frame for meeting the remedial goals.

2. It is my understanding that this RAWP is also the sampling and analysis plan for performance and compliance monitoring, while process monitoring will be detailed in the SEE Operation, Maintenance, and Monitoring (OM&M) manual (Section 5.6.3, page 5-5). In light of this fact, the RAWP must clearly state what compliance and performance monitoring will be done, where samples will be obtained, what type of samples they will be, and minimum frequency at which each of these types of samples will be obtained. This should include both screening sampling, such as data obtained with an instrument such as a Flame Ionization Detector (FID), as well as analytical samples. The document itself must also be consistent with the Quality Assurance Project Plan (QAPP) worksheets in Appendix H. My specific comments below list several places where information is lacking, discrepancies occur, or the information provided requires clarification. Additional information and/or clarification may be required in other sections to provide a comprehensive, consistent, and understandable sampling and analysis plan for the performance and compliance monitoring. It would be very helpful to have all of the performance and compliance sampling detailed in one location.

Specific Comments:

2. Section 4.2.2, page 4-5: Lines 1258 to 1260 state, "Monitoring of temperature within and at the perimeter of SEE, groundwater elevations and LNAPL accumulation outside the TTZ, and perimeter groundwater benzene concentrations will be used to demonstrate containment." Please clarify how temperature monitoring will be used to demonstrate containment, and how the temperature measurements will be made. Generally for a steam injection remediation using an outside-in approach to steam injection, temperature measurements at the perimeter of the treatment area cannot be used to demonstrate containment, as the steam will flow radially in all directions from the injection wells, heating the perimeter area outside of the TTZ as well as the TTZ. However, if some areas of the perimeter will be employing extraction only, temperature measurements may be useful to demonstrate containment. This comment also applies to Section 5.8, starting at line 1860, where the same statement is made.

3. Table 4-2: The third row of this table states that Mass Removal Rates of less then 10 percent of the peak removal rate is one of the target criteria for transition from SEE to EBR. In my experience at other thermal remediation sites, the peak extraction rates are high enough that significant quantities of contaminant mass are still being recovered when the extraction rate decreases to 10 percent of the peak rate. This may particularly be true at this site, where a very large quantity of contaminant mass is present in the subsurface. Generally, rather than stating a target reduction in mass recovery, the criteria used is 'diminishing returns' in mass recovery, or a low mass recovery rate that does not reduce further with time.

As is pointed out in the Description of this criteria, contaminant mass from around the perimeter of the TTZ may contribute a continuing source of mass for removal by the SEE system, even after recovery from the interior of the TTZ has decreased to a low rate. Performance monitoring should include being able to determine the amount of contaminant mass coming from the interior of the TTZ separate from the amount being recovered from the perimeter. If the removal rate

from the perimeter is as much as 10 percent of the peak mass recovery during SEE, then significant mass must exist outside of the TTZ, and consideration should be given to expanding the SEE to encompass this area. Without treating that area with SEE, it would be questionable that the cleanup criteria can be met in the desired timeframe.

4. Table 4-2: The last row of this table states that the cumulative mass of steam injected is a criteria to be evaluated to determine when to transition from SEE to EBR. While I understand that this criteria is based on modeling performed by TerraTherm, I am concerned that this type of criteria could be used as a maximum amount of steam to be injected in order to control the costs of the steam injection remediation, rather than as an indicator of the progress of the remediation that has to be balanced against other criteria. I would prefer that the mass of steam injected not be used as a criteria for determining when to transition from SEE to EBR.

5. Table 5-1: This table does not clearly define the baseline groundwater sampling to be performed. The table appears to show two rounds of sampling, the first to measure water levels and product accumulation in developed wells, the second round to obtain samples for Volatile Organic Compounds (VOCs) and Total Petroleum Hydrocarbons (TPH) from redeveloped wells. Please clarify what baseline groundwater sampling is to be performed.

6. Table 5-2: The first row of this table states permanent Temperature Monitoring Points (TMPs) will be installed at all Lower Saturated Zone (LSZ) Steam Injection Wells (SIWs), and mobile temperature arrays will be used to monitor temperatures in the remaining Multiphase Extraction Wells (MPEs) and SIW. I understand that temperature monitoring at the steam injection wells will show which intervals are taking steam and ensure that the bottom of the screen interval is receiving steam, however, intuitively, it would seem that the more valuable temperature data from both a process and performance monitoring viewpoint would be to determine when – and at what depths – the steam front breaks through at the MPE wells. What is the reason for having the thermocouples permanently at the SIW and only temporarily at the MPEs? This comment also applies to TerraTherm's Design for SEE Treatment (Appendix D), Section 2.2, page 4, last bullet.

7. Table 5-2: The second row of this table states that vapors produced during pressure cycling will be primarily monitored with hand held devices. Since hand held devices will not indicate how much benzene is produced during pressure cycling, please consider adding analytical samples during each pressure cycle, specifically to aid in determining the amount of benzene still being recovered.

8. Table 5-2: The third row of this table indicate that sampling will be performed to determine the mass removal rate. How will the mass extracted in the vapors at the vapor collection manifold be determined? How frequently will these measurements be made? How will mass in the air stripper off gas be measured, and how frequently will it be measured? What will the liquid samples be analyzed for – VOCs? TPH? How frequently will the liquid samples be analyzed? How frequently will the LNAPL level be measured in the storage tank?

Due to the rapidly changing concentrations in the vapor phase throughout thermal remediation, I recommend that analytical samples be collected from the vapor collection manifold weekly at a minimum, with FID samples collected daily. Extracted water concentrations will not be as variable, so monthly samples of the extracted water are likely adequate. Since LNAPL will be consumed in the boilers, the amounts entering and leaving the storage tank will have to be measured at the same frequency in order to know the total amount of LNAPL recovered.

9. Table 5-2: The fourth row of this table states that samples of extracted water will be used to evaluate benzene concentrations during SEE operations. Please specify the laboratory method to be used and the frequency with which these samples will be collected.

10. Section 5.6.3, page 5-8: The bullet on this page states that groundwater samples will be collected at the inlet to the water treatment system to track the progress of the remediation. How frequently will these samples be obtained?

11. Table 5-3: Will laboratory samples of the effluent from the stack be analyzed, or will only FID monitoring be used?

12. Table 5-4: Please show the locations of the perimeter groundwater monitoring wells on a figure that is readable (Figure 3 is not readable).

13. Table 5-5: Please show the locations of the wells to be abandoned and the replacement wells on a figure that is readable.

14. Appendix H, Worksheet No. 11, page 2: The eighth bullet on this page lists, "Has mass removal decreased, following pressure cycling, to rates less than or equal to the peak mass removal rate?" as a decision statement for the work plan. I believe a better decision statement would be, 'Has mass removal from the TTZ decreased, following pressure cycling, to a small, relatively constant rate?'

15. Appendix H, Worksheet No. 18, Table 18.4: The title of this table is, 'Process Sampling During Operation to Support Remediation Decisions'. However, it is not clear that most of the sampling included in this table will support remedial decisions, or it is not clear what is meant by 'remediation decisions'. If remediation decisions are meant to be the transition from SEE to EBR, then the performance monitoring listed in Table 5-2 (subsurface temperatures, vapor concentrations during pressure cycling (please see comment 7), recovered LNAPL as determined by flow meters and levels in LNAPL storage tanks, mass in extracted vapors as determined at the vapor collection manifold, mass in extracted water as measured in air stripper off gas and liquid laboratory samples, and benzene concentrations in extracted groundwater), should be included in Table 18.4. Sampling of the Thermal Accelerator Influent and Effluent (rows 1, 2, and 3) and GAC influent, midfluent, and effluent (rows 4, 5 and 6) appear to be compliance sampling (see page 5-7), and the sampling listed for the LNAPL Storage (row 7) appears to be process sampling, to determine the suitability of the LNAPL as a fuel source for the boilers. It would be

very helpful if performance sampling, compliance sampling and process sampling were all given in different tables.

16. Appendix H, Worksheet No. 18, page 8, Table 18.4: The sampling frequency for the GAC influent, midfluent, and effluent (rows 4, 5 and 6) is not consistent with that given in Section 5.6.2, page 5-7, third bullet.

17. Appendix H, Worksheet No. 18, page 9, Table 18.4: The ninth and tenth rows of this table states that the extraction manifolds and MPE wells will be sampled "At a minimum as needed at end of process to support transition decision making". It is not clear what this means.

18. Table 5-2 states, in the third row, that mass in extracted vapors will be measured at the vapor collection manifold in order to determine the amount of mass recovered in the vapor phase. This sampling does not appear to be included in Appendix H, Worksheet No. 18, Table 18.4.

Due to the extreme variability in vapor concentrations during thermal remediation, it is recommended that samples of the combined vapor stream be analyzed via T0-15 at least on a weekly basis, with daily FID readings. This will aid significantly in monitoring the amount of benzene recovered during different stages of the remediation, and will aid in determining when to transition from SEE to EBR.

19. Progress reports should include temperature distribution in the subsurface, the amount of contaminant mass recovered in each of the phases (LNAPL, aqueous phase, and vapor phase), water level and LNAPL levels from perimeter monitoring wells, and any additional samples that were collected to support the decision on when to transition from SEE to EBR.

If you would like to discuss any of these comments, I would be happy to do so. I can be reached at (580) 436-8548 or davis.eva@epa.gov.

cc: Ed Gilbert (5203P)
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